IEM's AI Modeling: Short-term COVID-19 Projections

Date: 4/12/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 4/12/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

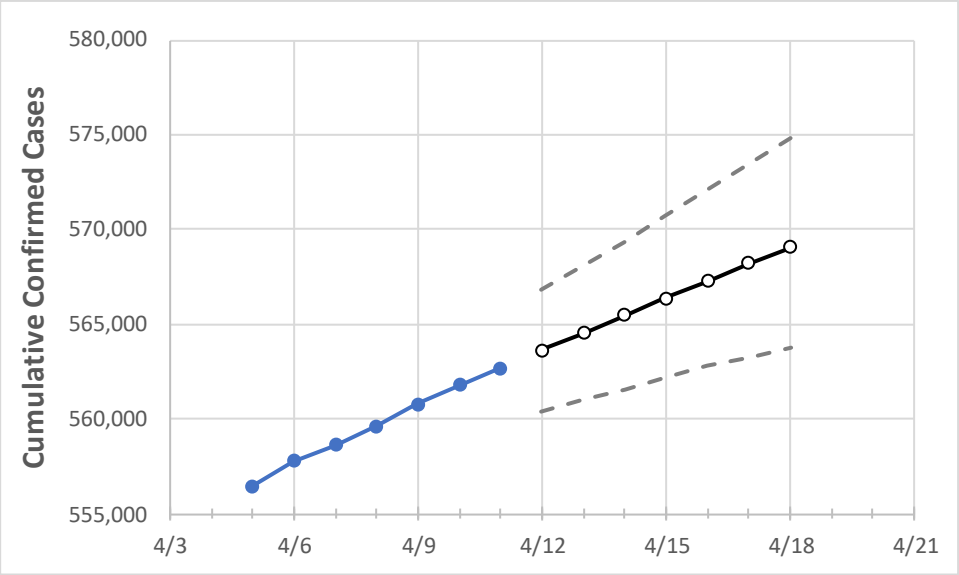
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

South Carolina State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
South Carolina	559,597	560,762	561,773	562,691	563,629	564,549	565,468	566,394	567,286	568,197	569,079

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

South Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
Beaufort	16,385	16,404	16,423	16,446	16,460	16,475	16,488	16,502	16,515	16,529	16,542
Charleston	41,231	41,310	41,390	41,471	41,545	41,619	41,690	41,764	41,836	41,909	41,978
Greenville	71,012	71,161	71,341	71,456	71,619	71,787	71,951	72,112	72,274	72,433	72,593
Kershaw	7,136	7,144	7,152	7,161	7,170	7,178	7,186	7,195	7,203	7,211	7,219
Lexington	31,985	32,036	32,083	32,135	32,179	32,223	32,268	32,312	32,356	32,397	32,440
Richland	44,409	44,510	44,599	44,664	44,736	44,805	44,876	44,946	45,016	45,085	45,157
Spartanburg	39,590	39,714	39,770	39,826	39,910	39,996	40,079	40,160	40,242	40,325	40,410
York	29,127	29,213	29,258	29,318	29,382	29,447	29,510	29,577	29,642	29,706	29,771

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

South Carolina Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	4/8	4/9	4/10	4/11	4/13	4/15	4/17
Beaufort	16,385	16,404	16,423	16,446	16,475 (3,295) [791] {395}	16,502 (3,300) [792] {396}	16,529 (3,306) [793] {397}
Charleston	41,231	41,310	41,390	41,471	41,619 (8,324) [1,998] {999}	41,764 (8,353) [2,005] {1,002}	41,909 (8,382) [2,012] {1,006}
Greenville	71,012	71,161	71,341	71,456	71,787 (14,357) [3,446] {1,723}	72,112 (14,422) [3,461] {1,731}	72,433 (14,487) [3,477] {1,738}
Kershaw	7,136	7,144	7,152	7,161	7,178 (1,436) [345] {172}	7,195 (1,439) [345] {173}	7,211 (1,442) [346] {173}
Lexington	31,985	32,036	32,083	32,135	32,223 (6,445) [1,547] {773}	32,312 (6,462) [1,551] {775}	32,397 (6,479) [1,555] {778}
Richland	44,409	44,510	44,599	44,664	44,805 (8,961) [2,151] {1,075}	44,946 (8,989) [2,157] {1,079}	45,085 (9,017) [2,164] {1,082}
Spartanburg	39,590	39,714	39,770	39,826	39,996 (7,999) [1,920] {960}	40,160 (8,032) [1,928] {964}	40,325 (8,065) [1,936] {968}
York	29,127	29,213	29,258	29,318	29,447 (5,889) [1,413] {707}	29,577 (5,915) [1,420] {710}	29,706 (5,941) [1,426] {713}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.